Reg. No. ☐☐☐☐☐☐☐☐☐☐

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: BIOFUELS ENGINEERING [BIO443]-Elective IV

REVISED CREDIT SYSTEM

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Answer **ANY FIVE FULL** the questions.

❖ Missing data may be suitable assumed.

1A.	Compare using LCA, the biodiesel obtained by Jatropha seeds vs. waste cooking oil	**3**
1B.	Elucidate the concept of a biorefinery with the example of bioethanol from Barley.	**2**

1C.	Describe the suitability of the following feedstocks for biofuels.
	    a) Wheat – Bioethanol
	    b) Rice Straw- Bioethanol
	    c) Agricultural residue- Biogas
	    d) Glycerol- Higher alcohols
		4

1D.	What is a third generation biofuel?	**1**
2A.	Explain the various strategies for detoxification of lignocellulose hydrolyzate	**3**

2B.	Compare the most promising pretreatment technologies given below for a typical lignocellulose such as Rusk Husk
	    a) Steam explosion
	    b) Mechanical
	    c) Liquid hot water
	    d) Alkali
		4

2C.	With a schematic diagram, explain wet milling process	**3**
3A.	Compare and contrast Octane number and Cetane number	**2**
3B.	Write a briefly an advantages and disadvantages for various microalgal drying technologies	**3**
3C.	It is desired to select a heterogeneous catalyst for transesterification process. What are the various factors/variable that need to be looked into while selecting Acid vs. Base catalysts and how does each one of them fare?	**3**
3D.	Compare raceway pond technology with photo-bioreactor for microalgae. Take your basis as 1,00,000 kg/year of biomass	**3**
4A.	Determine the fermentation efficiency for the following set of data Mash solid content-35%; Ethanol concentration -0.12 g/mL, Starch content of the solid- 70% on dry basis; Density of ethanol - 0.8 g/mL	**3**

4B.	Briefly outline the four different strategies for electron transfer in a MFC	**2**

4C.	The following contaminants were found in a biodiesel above certain permissible levels as laid by ASTM. What are the negative impacts of them on the engine?
	    1. Methanol
	    2. Water
	    3. FFA
	    4. Glycerol
		4

5A.	Draw and explain the voltage polarization curve of a MFC	**2**
5B.	Calculate the coulombic efficiency of MFC with the following parameters. Resistance 900Ω, COD 1g/L, Anode chamber volume = 0.1 L, Steady voltage 0.4 V (for 75 h)	**3**
5C.	a. Using Buswell equation, estimate the theoretical biogas composition from a waste whose elemental composition is $C_{450}H_{2050}O_{950}N_{12}S_1$. Coefficients of CO_2 and CH_4 are 1/8(4c-h+2o+3n+2s) and 1/8(4c+h-2o-3n-2s) respectively. b. Also, compute the biogas volume in Nm^3 from a 100 kg of wet waste of the above formula. Biodegradability = 70% and water content of the wet waste =70%	**1** **3**

6A.	Draw the schematic diagram of anaerobic degradation to generate biogas for the following feeds
	   i. Lipids
	  ii. Proteins
	    What are the roles of two different types of methanogenic species?
		5

6B.	For generation of hydrogen gas using photo-fermentation and dark fermentation, what are the advantages and disadvantages and future prospects?	**3**
6C.	Mention the three different strategies for enhancing biological hydrogen production processes	**2**